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# Folding of a single polygrain layer

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Shortening of a mechanically layered rock in the direction parallel to the layering leads to the formation of buckle folds. Simultaneously, the rock microstructure undergoes modification due to changes in geometry and arrangement of the minerals leading to the development of the shape preferred orientation (SPO) and mechanical anisotropy. The progressive deformation influences the effective mechanical properties, which may affect the evolution of the folds. The mechanical anisotropy is considered to have a first-order effect on the fold growth, thus its evolution is potentially a crucial factor in folding process. In contrast to the previous studies, where the anisotropy is often considered as a prescribed (or inherited) property, we treat the anisotropy as a parameter that develops and evolves during deformation.
In our numerical model, we study a polygrain, two-phase medium consisting of an effectively strong layer embedded in a weaker matrix. Both the layer and the matrix comprise the same material types but in different proportions. The layer and the matrix are initially mechanically isotropic. The viscosity of individual grains is isotropic, thus the role of the crystallographic orientation is not taken into account. The recrystallization and pressure solution processes are neglected. We investigate the influence of 1) the viscosity ratio between the mineral phases and 2) the effective viscosity ratio between the layer and the matrix on the development and evolution of anisotropy and folding.
The complex, polygrain structure is represented using Voronoi polygons, which are then discretized with an unstructured mesh using Triangle software developed by Shewchuk (2007) and then used for the [U+FB01]nite element approximations. We solve the incompressible Stokes equations under zero gravity using the finite element method (FEM) solver MILAMIN (Dabrowski et al., 2008). The normal components of the velocity vectors are prescribed at the boundaries according to a pure shear of a given rate and free slip boundary conditions are used for all the walls. Large spatial and temporal resolutions are used to reduce numerical error and to capture the evolution of grains.

References:
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